

Claims

1. A plasma ion source for producing negative ions, comprising:
a source chamber;
an RF antenna mounted external to the chamber;
an RF power source coupled to the RF antenna for generating a plasma containing positive ions in a gas in the source chamber;
a converter mounted in the source chamber and negatively biased with respect to the source chamber and plasma to produce the negative ions by sputtering surface ionization of the converter by the positive ions.
2. The plasma ion source of Claim 1 wherein the source chamber comprises a quartz tube mounted between a pair of end plates.
3. The plasma ion source of Claim 1 wherein the converter is made of LaB_6 to produce boron ions.
4. The plasma ion source of Claim 3 wherein the plasma generated in the source chamber is an argon ion plasma.
5. The plasma ion source of Claim 1 further comprising a cylindrical sputtering shield mounted in the source chamber.

6. The plasma ion source of Claim 5 wherein the cylindrical sputtering shield contains a plurality of spaced slots, one of the slots extending the length of the shield.

7. The plasma ion source of Claim 1 wherein the RF antenna is formed of a coil of copper or other conducting tubing.

8. The plasma ion source of Claim 1 wherein the source chamber further comprises:

an extraction aperture;

a pair of spaced extraction electrodes mounted at the aperture.

9. The plasma ion source of Claim 8 further comprising a magnetic filter mounted at the extraction aperture to reduce extracted electron current.

10. The plasma ion source of Claim 9 further comprising a pair of spaced electron separator magnets positioned after the extraction electrodes to deflect electrons.

11. The plasma ion source of Claim 8 wherein the converter surface has a spherical curvature with a radius equal to the length of the source chamber for focusing the negative ions on the extraction aperture.

12. The plasma ion source of Claim 1 wherein the plasma ion source operates at about 300-800 W RF power, 8-10 mTorr gas pressure, and 0.5-1 kV converter bias.